

### ***Remarks***

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 1-28 are pending in the application, with 1, 6, 12, 19, 23, and 26 being the independent claims. The specification is sought to be amended to update the cross references to related applications and to correct minor typographical errors. The Abstract is sought to be amended so that it contains no more than 150 words. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Based on the above amendment and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

### ***Examiner Interview***

Applicants' attorneys thank the Examiner for the Examiner interview conducted on December 17, 2002. During the interview, Applicants' attorneys discussed with the Examiner Applicants' invention, the independent claims, and the references applied by the Examiner.

### ***Changes to the Specification***

Applicants are amending the specification in order to update the cross references to related applications and to correct minor typographical errors. These changes do not add any new matter. Consideration and entry of these amendments are respectfully requested.

***Changes to the Abstract***

Applicants are amending the Abstract so that it contains no more than 150 words. This amendment does not add any new matter. Consideration and entry of this amendment are respectfully requested.

***Rejections under 35 U.S.C. § 102***

In paragraph 3 of the Office Action, the Examiner rejected claims 1, 3-6, 9, 11-13, and 15-28 under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,606,731 to Pace *et al.* (hereafter Pace). Applicants respectfully traverse this rejection.

As discussed with the Examiner during the Examiner interview, conventional down-converting systems and methods sample FM signals at a rate greater than or equal to the Nyquist sampling rate (e.g., twice the frequency of the FM signal) in order to avoid a type of signal distortion called aliasing. Aliasing causes frequency components that are higher than half of the sampling frequency to overlap with the lower frequency components.

Applicants' invention is very different from conventional down-converting systems and methods. In an embodiment, Applicants' invention involves (1) aliasing an FM signal at an aliasing rate substantially equal to the frequency of the FM signal or substantially equal to a sub-harmonic thereof, (2) adjusting the aliasing rate in accordance with frequency changes on the FM signal to maintain the aliasing rate substantially equal to the frequency of the FM signal, and (3) outputting a demodulated baseband information signal.

Accordingly, claim 1 recites:

1. A method for down-converting a frequency modulated (FM) signal, comprising the steps of:
  - (1) aliasing the FM signal at an aliasing rate, said aliasing rate being determined by the frequency of the FM signal;
  - (2) adjusting said aliasing rate to compensate for frequency changes of the FM signal; and

(3) outputting, responsive to steps (1) and (2), a demodulated baseband information signal.

As recited in claim 1, "aliasing the FM signal at an aliasing rate" means aliasing the FM signal at a rate that is less than the Nyquist sampling rate.

Pace does not teach or suggest the combination of features recited in independent claim 1. For example, nowhere does Pace teach or suggest "aliasing the FM signal at an aliasing rate" and "adjusting said aliasing rate to compensate for frequency changes of the FM signal." As discussed with the Examiner during the examiner interview, the mixer 16 in Pace does not perform the step of "aliasing the FM signal at an aliasing rate," nor does the AFC signal processor 50 in Pace perform the step of "adjusting said aliasing rate to compensate for frequency changes of the FM signal."

Since Pace does not teach or suggest the combination of features recited in claim 1, claim 1 is patentable over Pace. Reconsideration and withdrawal of the rejection of claim 1 are respectfully requested.

Independent claims 6, 12, 19, 23, and 26 recite features similar to those of independent claim 1. Thus, these independent claims are also patentable over Pace for at least the same reasons that claim 1 is patentable over Pace. Reconsideration and withdrawal of the rejection of claims 6, 12, 19, 23, and 26 are respectfully requested.

Claims 3-5, 9, 11, 13, 15-18, 20-22, 24, 25, 27, and 28 each depend, either directly or indirectly, from one of the independent claims 1, 6, 12, 19, 23, or 26. Thus, claims 3-5, 9, 11, 13, 15-18, 20-22, 24, 25, 27, and 28 are patentable over Pace for at least the same reasons that independent claims 1, 6, 12, 19, 23, or 26 are patentable over Pace. Reconsideration and withdrawal of the rejection of claims 3-5, 9, 11, 13, 15-18, 20-22, 24, 25, 27, and 28 are respectfully requested.

### ***Rejections under 35 U.S.C. § 103***

In paragraph 5 of the Office Action, the Examiner rejected claims 2, 10, and 14 under 35 U.S.C. § 103 as being unpatentable over Pace. Applicants respectfully traverse this rejection.

For at least the reasons given above, independent claims 1, 6, and 12 are patentable over Pace. Claims 2, 10, and 14 depend, either directly or indirectly, from independent claims 1, 6, and 12, respectfully. Thus, claims 2, 10, and 14 are also patentable over Pace for at least the same reasons that claims 1, 6, and 12 are patentable over Pace. Reconsideration and withdrawal of the rejection of claims 2, 10, and 14 are respectfully requested.

In paragraph 6 of the Office Action, the Examiner rejected claims 7 and 8 under 35 U.S.C. § 103 as being unpatentable over Pace in view of U.S. Patent No. 5,600,680 to Mishima *et al.* (hereafter Mishima). Applicants respectfully traverse this rejection.

For at least the reasons given above, independent claim 6 is patentable over Pace. Claims 7 and 8 depend from independent claim 6. Thus, claims 7 and 8 are also patentable over Pace for at least the same reasons that claim 6 is patentable over Pace. Mishima does not overcome the deficiencies of Pace. Thus, claims 7 and 8 are patentable over Pace and Mishima, either alone or in combination. Reconsideration and withdrawal of the rejection of claims 7 and 8 are respectfully requested.

### ***Conclusion***

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

  
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**Version with markings to show changes made**

***In the Specification:***

Please substitute the following nine paragraphs for the nine paragraphs beginning on page 1, line 12, and ending on page 2, line 5:

--This application claims the benefit of U.S. Provisional Application No. 60/116,848, filed January 22, 1999.

The following applications of common assignee are related to the present application, and are herein incorporated by reference in their entireties:

"Method and System for Down-Converting Electromagnetic Signals," Serial No. 09/176,022, filed on October 21, 1998 (now U.S. Patent No. 6,061,551).

"Method and System for Frequency Up-Conversion," Serial No. 09/176,154, filed on October 21, 1998 (now U.S. Patent No. 6,091,940).

"Method and System for Ensuring Reception of a Communications Signal," Serial No. 09/176,415, filed on October 21, 1998 (now U.S. Patent No. 6,061,555).

"Integrated Frequency Translation and Selectivity," Serial No. 09/175,966, filed on October 21, 1998 (now U.S. Patent No. 6,049,706).

"Image-Reject Down-Converter and Embodiments Thereof, Such as [hte] the Family Radio Service," Serial No. 09/476,091 [*to be assigned*, Attorney Docket No. 1744.0240001], filed January 3, 2000 [\_\_\_\_\_].

"Communication System With Multi-Mode and Multi-Band Functionality and Embodiments Thereof, Such as the Family Radio Service," Serial No. 09/476,093 [*to be assigned*, Attorney Docket No. 1744.0260001], filed January 3, 2000 [\_\_\_\_\_].

"Multi-Mode, Multi-Band Communication System," Serial No. 09/476,330 [*to be assigned*, Attorney Docket No. 1744.0330001], filed January 3, 2000 [\_\_\_\_\_].--

Please substitute the following paragraph for the paragraph beginning on page 6, line 17:

--U.S. Patent Application 09/176,022, titled, "Method and System for Down-Converting Electromagnetic Signals," (now U.S. Patent No. 6,061,551; hereinafter referred to as the ['022 application] '551 patent') incorporated herein by reference in its entirety, discloses methods and systems for directly down-converting EM signals.--

Please substitute the following paragraph for the paragraph beginning on page 6, line 21:

--The ['022 application] '551 patent' discloses, among other things, how modulated EM signals can be directly down-converted to demodulated baseband information signals (also referred to interchangeably herein as direct to data or D2D embodiments). For example, amplitude modulated (AM) signals and phase modulated (PM) signals can be directly down-converted to demodulated baseband information signals by aliasing the AM and PM signals at sub-harmonics of the AM and PM signals.--

Please substitute the following paragraph for the paragraph beginning on page 7, line 5:

--Frequency modulated (FM) signals, however, pose special challenges. For example, the ['022 application] '551 patent' discloses how frequency shift keying (FSK) signals, when aliased at a fixed sub-harmonic, are down-converted to amplitude shift keying signals or to phase shift keying (PSK) signals. FM signals, unlike AM and PM signals, are not necessarily directly down-converted to demodulated baseband information signals by aliasing at a fixed sub-harmonic.--

Please substitute the following paragraph for the paragraph beginning on page 7, line 21:

--The zero IF FM decoder 502 includes a first aliasing module 510 and a second aliasing module 512. Preferably, the first and second aliasing modules 510 and 512 are implemented as disclosed in the ['022 application] '551 patent' and may be optimized as illustrated in FIGS. 1-3 of the present application and as described above. Other

components of the zero IF FM decoder 502 are described below with the description of the process flowchart 402.--

Please substitute the following paragraph for the paragraph beginning on page 8, line 4:

--In FIG. 5, step 410 is performed by the first and second aliasing module 510 and 512. The first aliasing module 510 receives an FM signal 514 and a first [a] LO signal 516. The first LO signal 516 is substantially equal to the frequency of the FM signal 514 or a sub-harmonic thereof. Details of maintaining the LO signal 516 at the frequency of the FM signal 514, or a sub-harmonic thereof, is described in connection with step 412 below. The first aliasing module 510 uses the first LO signal 516 to down-convert the FM signal 514 to a first down-converted signal 518, as disclosed in the ['022 application] '551 patent.--

Please substitute the following paragraph for the paragraph beginning on page 8, line 18:

--In an exemplary embodiment, the first and second LO signals 516 and 520 are separated by 1/4 period of the FM signal 514, or any multiple of a period of the FM signal 514 plus 1/4 period. Other phase differences are contemplated and are within the scope of the present invention. The second aliasing module 512 uses the second LO signal 520 to down-convert the FM signal 514 to a second down-converted signal 522, as disclosed in the ['022 application] '551 patent.--

Please substitute the following paragraph for the paragraph beginning on page 8, line 27:

--The ['022 application] '551 patent teaches that, so long as an aliasing rate remains substantially equal to the frequency of an FM signal, the resultant down-converted signal is substantially a constant level. In the case of the zero IF FM decoder 502, therefore, the first and second down-converted signals 518 and 522 should generally be constant signals.--



Please substitute the following paragraph for the paragraph beginning on page 12, line 12:

--The present invention can be implemented with an aliasing system as disclosed in [U.S. Patent Application 09/176,022, titled, "Method and System for Down-Converting Electromagnetic Signals," (hereinafter referred to as the '022 application)] '551 patent, incorporated herein by reference in its entirety.--

Please substitute the following paragraph for the paragraph beginning on page 12, line 20:

--The exemplary aliasing system 100 includes an aliasing module 110 that aliases an EM signal 112, using an aliasing signal 114, and outputs a down-converted signal 116, as disclosed in [U.S. Patent Application 09/176,022, titled, "Method and System for Down-Converting Electromagnetic Signals," (hereinafter referred to as the '022 application)] '551 patent, incorporated herein by reference in its entirety. The aliasing module 110 is also referred to herein as a universal frequency translator (UFT) module.--

Please substitute the following paragraph for the paragraph beginning on page 13, line 3:

--Aliasing system 100 optionally includes one or more of an input impedance match module 118, a parallel resonant tank module 120, and an output impedance match module 122, as disclosed in the ['022 application] '551 patent.--

Please substitute the following paragraph for the paragraph beginning on page 14, line 8:

--The exemplary schematic diagram 202 includes a storage module 210 for storing energy transferred from the EM signal 112, as disclosed in the ['022 application] '551 patent.--

Please substitute the following paragraph for the paragraph beginning on page 14, line 27:

--FIG. 3 illustrates an aliasing module 302, which is an exemplary embodiment of the aliasing module 110 and the ASIC 212. The aliasing module 302 includes a sine wave to square wave converter module 310, a pulse shaper module 312 and a switch module 314. The sine wave to square wave converter module 310 converts a sine wave 114 from the local oscillator 128 to a square wave 311. The pulse shaper module 312 receives the square wave 311 and generates energy transfer pulses 313 therefrom. Energy transfer pulses are discussed in greater detail in the ['022 application] '551 patent.--

Please substitute the following paragraph for the paragraph beginning on page 18, line 14:

--In one implementation of the invention, switch 906 is a field effect transistor (FET). A specific implementation wherein the FET is a complementary metal oxide semiconductor (CMOS) FET is shown [is] in FIG. 11. A CMOS FET has three terminals: a gate 1102, a source 1104, and a drain 1106. String of pulses 910 is shown at gate 1102, bias signal 814 is shown at source 1104, and rectangular waveform 834 is shown at drain 1106. Those skilled in the relevant art(s) will appreciate that the source and drain of a FET are interchangeable, and that bias signal 814 could be at the drain 1106, with rectangular waveform 834 being at the source 1104. Numerous circuit designs are available to eliminate any possible asymmetry, and an example of such a circuit may be found in [co-pending U.S. Patent Application 09/176,154] U.S. Patent No. 6,091,940, entitled "Method and System for Frequency Up-Conversion," [filed October 21, 1998,] the full disclosure of which is incorporated herein by reference.--

Please substitute the following paragraph for the paragraph beginning on page 20, line 8:

--The inventions described above can be implemented individually. Alternatively, two or more of the inventions described above can be implemented in combination with one another. For example, one or both of the ultra-low power down-converter and zero IF FM decoder can be implemented with the high efficiency transmitter described above, as a

transceiver. Also, one or both of the ultra-low power down-converter and zero IF FM decoder can be implemented with a transmitter designed in accordance with the disclosure provided in [co-pending U.S. Patent Application 09/176,154] U.S. Patent No. 6,091,940, titled, "Method and System for Frequency Up-Conversion," [filed October 21, 1998,] incorporated herein by reference in its entirety.

***In the Abstract:***

Please substitute the following Abstract, which is also reproduced on a separate page filed herewith, for the pending Abstract:

--A method and system for directly down-converting FM signals to demodulated baseband information signals that can be used to directly down-convert analog FM signals and digital FM signals to demodulated baseband information signals. In an embodiment, the method includes aliasing an FM signal at an aliasing rate substantially equal to the frequency of the FM signal or substantially equal to a sub-harmonic thereof; adjusting the aliasing rate in accordance with frequency changes on the FM signal to maintain the aliasing rate substantially equal to the frequency of the FM signal, and outputting a demodulated baseband information signal. The method optionally includes compensating for phase delays and/or other characteristics of the loop in order to maintain bandwidth and stability for the loop. [In an embodiment, the invention is implemented as a zero IF FM decoder that down-converts an FM signal as an I and Q pair, sums the I and Q pair, and generates a correction signal from the sum. The correction signal is used to adjust the aliasing rate to continually alias the FM signal at a sub-harmonic of the FM signal - even as the FM signal changes frequency. In an embodiment, the invention is implemented as an ultra-low power down-converter. In an embodiment, the invention is implemented as a transceiver, which can be an FRS transceiver. Advantages of the invention include, but are not limited to, power reduction, parts reduction, price reduction, size reduction, performance increase, efficiency, and integration possibilities.]--

# **Analog Zero IF FM Decoder and Embodiments Thereof, Such as the Family Radio Service**

## ***Abstract***

A method and system for directly down-converting FM signals to demodulated baseband information signals that can be used to directly down-convert analog FM signals and digital FM signals to demodulated baseband information signals. In an embodiment, the method includes aliasing an FM signal at an aliasing rate substantially equal to the frequency of the FM signal or substantially equal to a sub-harmonic thereof; adjusting the aliasing rate in accordance with frequency changes on the FM signal to maintain the aliasing rate substantially equal to the frequency of the FM signal, and outputting a demodulated baseband information signal. The method optionally includes compensating for phase delays and/or other characteristics of the loop in order to maintain bandwidth and stability for the loop.